A highly-affordable, ultradense, uniprocessor server delivering power-optimized performance for non-virtualized application workloads

Product Guide
January 2008

IBM System x3350

Product Overview

A 1U uni server with the power of a 2-socket server

[***Suggested uses:*** Workloads that traditionally require dual-processor systems, such as e-mail and collaboration, Web serving and Java-based applications; deployments that require a dedicated server with high RAS features; branch office and departmental server.]

You need the RAS features of a 1U two-socket server, but without the second processor. The IBM® **System x3350**, incorporating IBM **X-Architecture**™ features, is a cost-efficient solution to that dilemma. It's a **single-socket** commercial application server that provides outstanding reliability, availability and serviceability features, management control and levels of performance previously available only with dual-processor systems. The x3350 affords lower costs, with leaner power and cooling consumption than competitive 1U, two-processor servers. It supports, at the high end, the latest enterprise-ready **quad-** and **dual-core** Intel® **Xeon**™ processors, designed with a speedy **1066MHz** front-side bus (FSB) and **8MB** (quad-core) or **1333MHz FSB** and **4MB** (dual-core) of L2 cache, to help provide the computing power you need to match your business needs and growth. In addition, the x3350 uses industry-standard **DDR II 667MHz** memory with **ECC** (Error Checking and Correcting) protection—for high performance and reliability. **Dual** integrated high-speed **Gigabit Ethernet** controllers with **load-sharing** and **failover** support are standard, as are **two** high-performance **x8 PCI-E** adapter slots.

All models offer impressive scalability, including up to **8GB** of memory and a choice of high-performance hard disk drives with an internal storage capacity of **600GB** (**two 3.5-inch hot-swap SAS**), **587.2GB** (**four 2.5-inch hot-swap SAS**), or **1.5TB** (**two 3.5-inch hot-swap** or **simple-swap Serial ATA II**). The integrated SAS/SATA controller provides *hardware*-based **RAID-0**/**1** standard for the hot-swap drives. (**Simple-swap** SATA models are *upgradeable* to RAID-0/1 support.) The ultradense **1U** form factor allows businesses to increase their computing power and spread their workload without outgrowing their current data center. Up to **42** of these **1U** servers can be installed in a single 42U rack, for a total of up to **42** processors and **168** processor cores. Optional Advanced Cabling Technology (**ACT)** reduces cable clutter and cost and minimizes installation time when interconnecting many rack-mounted servers.

Standard in the x3350 is an integrated **Baseboard Management Controller** (BMC) that enables the user to manage and control the server easily—both locally and remotely. This level of manageability is designed to keep costs down and the system up—even when network usage increases. The drop-down **light path diagnostics** panel enables quick servicing of the system if a problem develops. Advanced features help maximize network availability by increasing uptime, including **simple-swap SATA HDDs**; **hot-swap/redundant SAS HDDs**, integrated **RAID**; **temperature-controlled fans** with **Calibrated Vectored Cooling**™; **IPMI 2.0** support, including **highly secure remote power control**, and **IPMI over LAN**.

With the inclusion of unique IBM service and support features such as the BMC, light path diagnostics, **IBM Director**, **IBM Systems Director Active Energy Manager for x86** (formerly known as PowerExecutive), **IBM ServerGuide**™ and support for the optional slotless **Remote Supervisor Adapter II SlimLine**, the x3350 is designed for superior uptime.

If you need highly manageable, single-socket/dual- or quad-core computing power, or low cost in a rack-dense package, the x3350 is the ideal system.

CONTENTS

Product Overview	1
Selling Features	1
Key Features	3
Key Options	9
x3350 Images	11
x3350 Specifications	12
The Bottom Line	14
For More Information	17
Legal Information	17

Selling Features

Price/Performance

The x3350 offers numerous features to boost performance and reduce product and operating costs:

- **High-performance quad-core** or **dual-core** Xeon processor, high-end **1333MHz** FSB with **4MB** or **6MB** (dual-core) or **6MB** or **12MB** (quad-core) of integrated Level 2 cache per processor, offering superior performance capable of tackling the toughest jobs.
- **Energy-efficient processors** draw less power and produce lest waste heat than higher-voltage processors, thus helping to reduce data center energy costs. The Xeon processors, especially, are highly power-efficient, consuming only **65W** per *dual*-core processor (**32.5W** *per core*) or **95W** per *quad*-core processor (**23.75W** *per core*).

Please see the Legal Information section for important notices and information.

- Ultra-fast **667MHz PC2-5300 DDR II** ECC memory provides speed and high availability.
- Two **high-throughput PCI-E x8 adapter slots** offer potential investment protection by supporting high-performance adapters, such as Gb Ethernet, Fibre Channel and InfiniBand cards, none of which will run in older legacy PCI slots.
- Integrated **RAID-0**/**1** support (standard in *hot*-swap models; optional in *simple*-swap models) at no extra charge and without consuming a valuable adapter slot. RAID-0 offers improved disk performance via data striping and RAID-1 offers disk mirroring for high availability. The x3350 is upgradeable to full **RAID-10**/**5**/**6** support, using the optional **ServeRAID-MR10i** card. It also offers higher performance, with **256MB** of optional onboard write-back ECC cache memory with battery backup.
- Up to **two 3.5-inch** or **four 2.5-inch** (depending on the model) **hot-swap SAS** hard disk drives offer high-performance with high availability. The SAS controller provides **full**-duplex (**2 x 300MBps**) data transfers for SAS drives. For lower cost and high capacity, other models support up to **two simple-swap Serial ATA** drives. The SATA II drives offer performance nearly equal to that of Ultra320 SCSI (**300MBps half**-duplex vs. 320MBps half-duplex, respectively).
- The integrated **dual Gigabit Ethernet** controllers with **IPMI 2.0** support provide high-speed network communications with **failover** capability.
- A **high degree of device integration**—including SAS or SATA, RAID, dual Gigabit Ethernet, systems management and video controllers—lowers costs and frees up valuable adapter slots.

Flexibility

The x3350 has the ability to grow with your application requirements, thanks to:

- A choice of processors with **2.33** to **3.0GHz** clock rates, **1333MHz** FSB, and **65W** to **95W** power draw.
- Up to **8GB** of high-speed DDR2 system memory in **four** DIMM slots.
- **Two** *available* **high-performance PCI-E** adapter slots in all models.
- The optional **ServeRAID-MR10i** controller supports up to **four** *internal* drives in a **RAID-0**/**1**/**10**/**5**/**6** array.
- The **four USB 2.0** ports are up to **40X** faster[1] than older **USB 1.1** ports. This provides speedy access to external HDDs (non-arrayed), optical drives, tape drives, and other USB devices. Two ports are on the front of the unit and two are on the back.
- The integrated BMC is upgradeable to the advanced BMC capability of the **Remote Supervisor Adapter II SlimLine**[2].
- A choice of up to **two** internal **3.5-inch hot-swap SAS** or **simple-swap SATA II** HDDs or **four 2.5-inch hot-swap SAS HDDs** (depending on the model) offer a variety of storage options. The 3.5-inch SAS models provide a maximum of **600GB** of internal **hot-swap** storage. The 2.5-inch SAS models support up to **587.2GB** of **hot-swap SAS** storage. The 3.5-inch SATA models (hot-swap or simple-swap) provide a maximum of **1.5TB** of internal **simple-swap** storage.
- Alternatively, iSCSI or Fibre Channel-attached storage can be attached using **IBM System Storage** or **TotalStorage**™ servers.

Manageability

Powerful systems management features simplify local and remote management of the x3350:

- The x3350 includes a **Baseboard Management Controller (BMC)** provides enterprise-class systems management, by monitoring server availability, performing Predictive Failure Analysis, etc., and then triggering IBM Director alerts. The BMC enables service personnel to use sophisticated diagnostic tools, such as light path diagnostics, to resolve problems quickly.
- Integrated **IPMI 2.0** support alerts IBM Director to anomalous environmental factors, such as voltage and thermal conditions. It also supports **highly secure remote power control** using data encryption.
- IBM **Director** is provided for proactive systems management. It comes with a portfolio of tools, including *Management Processor Assistant, RAID Manager, Update Assistant,* and *Software Distribution*. In addition, IBM Director offers extended systems management tools for additional server management and increased availability.
- An optional **Remote Supervisor Adapter II SlimLine** provides additional advanced systems

[1] Data transfer rates may be less than the maximum possible.
[2] Although the Remote Supervisor Adapter II SlimLine has a dedicated slot, its use precludes the use of adapter **Slot 2**.

Please see the Legal Information section for important notices and information.

management capabilities, including *Web-based out-of-band control; virtual floppy and optical drive support; Windows "blue screen" error capture; LDAP and SSL support;* and *remote redirection of PCI video, text, keyboard and mouse*.

Availability and Serviceability

The x3350 provides many features to simplify serviceability and increase system uptime:

- **Toolless cover removal** provides easy access to upgrades and serviceable parts. Similarly, many components can be installed or replaced without tools. This means less time (and therefore less money) spent servicing the x3350. In addition, **hot-swap/simple-swap HDDs**, can mean greater system uptime while these components are being serviced.
- **Toolless slides** ship with the server. They allow the rack server to easily slide into place without the need for tools.
- **Integrated RAID-1 disk mirroring arrays** standard (hot-swap models) enable the server to keep operating in the event of a failure to any one drive.
- The **drop-down light path diagnostics panel** and individual light path LEDs quickly lead the technician to failed (or failing) components. This simplifies servicing, speeds up problem resolution and helps improve network availability.
- **IPMI 2.0** supports highly secure remote system power control using data encryption. This allows an administrator to restart a server without having to visit it in person, saving travel time and getting the server back up and running quickly and securely.
- **Temperature-controlled fans** adjust to compensate for changing thermal characteristics. At the lower speeds they draw less power and suffer less wear. Equally important in a crowded data center, temperature-controlled fans produce less ambient noise in the data center than if they were constantly running at full speed.
- The **three-year (parts and labor) limited onsite warranty**[3] (model-specific) offers peace of mind and greater potential investment protection than a one-year warranty does.

Key Features

High-Performance/Low-Power Processors

The x3350 supports one of several low-cost or high-performance processors, allowing you to choose the processor that best fits your business needs. The x3350 offers a choice of processor clock rates, FSB speeds and power draw:

- **95W quad-core Xeon** processor models **X3350** or **X3360** running at **2.66** or **2.83GHz** (respectively), with 64-bit extensions, (**23.75W** per core), a **1333MHz** FSB, and **12MB** of L2 processor cache (2 x 4MB)
- **95W quad-core Xeon** processor model **X3320** running at **2.5GHz**, with 64-bit extensions, (**23.75W** per core), a **1333MHz** FSB, and **6MB** of L2 processor cache (2 x 4MB)
- **65W** dual-core **Xeon** processor model **E3110** running at **3.0GHz**, with 64-bit extensions, *low power draw* (**32.5W** per core), a **1333MHz** FSB, and **6MB** of L2 processor cache
- **65W** dual-core **Xeon** processor models **3065** or **3075** running at **2.33** or **2.66GHz** (respectively), with 64-bit extensions, *low power draw* (**32.5W** per core), a **1333MHz** FSB, and **4MB** of L2 processor cache

The **dual-core** processors contain **two complete processor cores**; **quad-core** processors, similarly, contain **four** cores. Dual-core processors contain one **unified** cache **shared** by both cores, while quad-core processors have **independent** caches (one per pair of cores). The shared cache is dynamically allocated between the two cores as needed. The two cores appear to software as two physical processors. The dual-core processors offer considerably higher performance than a same-speed Xeon processor with a single core. Likewise, quad-core processors offer considerably higher performance than a same-speed Xeon processor with dual cores.

Intel **Extended Memory 64 Technology (EM64T)** 64-bit extensions allow the Xeon processor to use large memory addressing when running with a 64-bit operating system. This in turn lets individual software processes directly access more than 4GB of RAM, which was the limit of 32-bit addressing. This can result in much higher performance for certain kinds of programs, such as database management and CAD. Additional registers and instructions (SSE3) can further boost performance for applications written to use them. Contact your software provider to determine their software support for EM64T.

The **1333MHz** FSB (which connects memory to the processor) offers a peak rate of **10.67GBps**, or up to **two-thirds** higher throughput at the same processor clock speed than an **800MHz** FSB

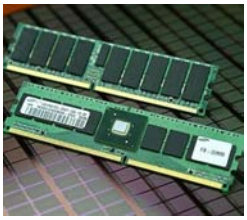
[3] For terms and conditions or copies of the IBM Statement of Limited Warranty, call 800-772-2227 in the U.S. In Canada call 800-426-2255. Telephone support may be subject to additional charges. For warranties including onsite labor, a technician is sent after IBM attempts to resolve the problem remotely. International warranty service is available in any country in which this product is sold.

Please see the Legal Information section for important notices and information.

This may result in much higher data transfer rates.

Intelligent Power Capability powers individual processor elements on and off as needed, to reduce power draw.

Execute Disable Bit functionality can help prevent certain classes of malicious buffer overflow attacks when combined with a supporting operating system.



DDR II ECC Memory

The x3350 ships with **two** DIMMs and supports up to **8GB** of memory in **4** DIMM sockets. It uses **PC2-5300** double data rate II (DDR II) memory (operating at **667MHz**) for fast access, and **ECC** memory protection, for potentially higher system availability than non-ECC memory can provide.

The system requires either **two** or **four** DIMMs and operates in **two-way interleaved** mode, for higher performance than noninterleaved mode. Additional memory is available in kits consisting of *two* **512MB**, **1GB**, or **2GB** DIMMs.

High-Performance Adapter Slots

The x3350 provides **two x8** ("by 8") **4GBps PCI-E (PCI Express)** adapter slots standard. Each is capable of supporting physical **x1**/**x4**/**x8** adapters at their rated speeds. Both slots are **half-length**/**full-height**.

PCI Express is a high-performance, low-latency, next-generation serial I/O bus that is rapidly replacing the older parallel PCI and PCI-X buses. A **x8** PCI-E adapter offers approximately *four times* the maximum throughput of a 133MHz PCI-X adapter[4]. (A **x1** adapter offers throughput similar to a **66MHz** PCI-X slot.)

Because the **SAS**/**SATA**, dual **Gigabit Ethernet**, **BMC** and **video** controllers are integrated onto the system board, the two adapter slots are both *available*, which offers a wide degree of latitude in expansion options.

Large HDD Storage Capacity

The x3350 offers a choice of disk storage, supporting up to **two** (**3.5**-inch) or **four** (**2.5**-inch) **hot-swap** high-performance **SAS** drives, or **two** (**3.5**-inch) **hot-swap**[5] or **simple-swap SATA II** drives:

3.5-inch SAS

- **10,000** RPMs —73.4, 146.8 or **300GB** (**600GB** maximum)
- **15,000** RPMs —73.4 or **146.8GB** (**293.6GB**)

2.5-inch SAS

- **10,000** RPMs —73.4 or **146.8GB** (**587.2GB**)

3.5-inch SATA

- **7,200** RPMs —160, 250, 500, or **750GB** (**1.5TB**)

Notes: 2-5-inch drives not only require less space than 3.5-inch drives, they *weigh less, consume half the power, produce less noise, seek faster,* and offer *increased reliability*. Simple-swap SATA drives are *not* hot-swappable (the system must first be powered off); however, no tools or jumpers are required for installation and removal, allowing for faster, simpler servicing than fixed drives. The hot-swap SAS drives use the Converged Tray for interchangeability with other IBM System x™ systems. If you need more storage space, terabyte capacities are possible with external direct-attach, NAS and SAN solutions. The x3350 does not support mixing SAS and SATA drives, or 10K and 15K RPM drives in the same system.

Drive Bays

The x3350 contains *either* **three** or **five** drive bays in all, depending on the model. Some models offer **two 3.5-inch** bays that support **hot-swap SAS** or **SATA II**[6] or **simple-swap SATA II** drives. This enables up to two slimline (1.0") drives to be installed, totaling up to **600GB** (SAS) or **1.5TB** (SATA).

Other models feature **four 2.5-inch** bays that support **hot-swap SAS** drives totaling up to **587.2GB**.

Hot-swap drives may be inserted or removed through the front of the server without powering off the system. Simple-swap drives can be inserted or removed through the front of the server without tools as well; however, the system power must first be turned off.

[4] Actual throughput will depend on the adapter vendor's implementation.
[5] Hot-swap SATA drives are supported in special bid or CTO systems only.
[6] Hot-swap SATA drives are supported in special bid or CTO systems only.

For additional storage, a direct-attach, iSCSI or FC SAN external expansion option can be added, using an optional controller.

A **24X/24X/24X/10X**[7] speed (ultraslim, 0.5"/12.7mm) **CD-RW/DVD-ROM Combo** drive with an IDE interface ships standard in all x3350 servers. No diskette drive is supplied; an external USB floppy drive may be used, if needed.

Disk Controllers

All **hot-swap** x3350 models include an integrated **LSI 1064E Serial-Attach SCSI (SAS)** controller. This controller supports up to **four** internal **2.5-inch** SAS LVD (low-voltage differential) drives, or **two 3.5-inch SAS** or **SATA** drives. **Simple-swap SATA** models have a separate controller, which supports up to **two** internal SATA drives. (The LSI RAID controller is available as an *option* for the simple-swap models.)

The integrated LSI **RAID** controller offers *hardware* **RAID-0**/**1** support for the hot-swap drives, without consuming a valuable adapter slot. The controller provides data transfer speeds of up to **300MB** per second (**3Gbps**)[8] in *each* direction (**full-duplex**) to **SAS** drives, for an aggregate speed of **600MBps**, nearly double that of Ultra320 SCSI's **320MBps** (half-duplex) bandwidth. The serial design of the SAS bus allows maximum performance to be maintained as additional drives are added.

SATA II drives also operate at a data transfer speed of up to 300MB per second (but in **half-duplex** mode). The SATA 3Gbps controller integrated in the **simple-swap SATA** models supports up to **two** internal SATA II drives, with maximum data transfer rates of up to **300MB** (**half-duplex**) per second. This is throughput is similar to that of Ultra320 SCSI.

The optional **ServeRAID-MR10i** full-height/half-length PCI-E x8 controller supports up to **four** *internal* SAS or SATA HDDs. It provides **RAID-0**/**1**/**10**/**5**/**6**[9] support and **256MB** of optional onboard write-back cache (with battery backup).

For external storage, the **ServeRAID-MR10M** PCI-E x8 controller enables connection to up to **four** IBM System Storage **EXP3000** SAS expansion units (**48** HDDs total). It provides **RAID-0**/**1**/**10**/**5**/**50**/**6**/**60** support and **256MB** of onboard cache.

Additional external SAS/SATA storage is available using the optional **IBM HBA SAS** controller, or one of several supported iSCSI or FC SAN HBAs.

Dual Gigabit Ethernet Controllers

The x3350 includes **two** integrated **Broadcom 5722** Gigabit Ethernet controllers for up to 10X higher maximum throughput than a 10/100 Ethernet controller. Both support **load balancing** and **failover**.

Both controllers support highly secure remote power management using **IPMI 2.0**, plus **Wake on LAN®** and **PXE** (Preboot Execution Environment) flash interface. Optional PCI adapters offering failover and load balancing between adapters are available for added throughput and increased system availability.

Hot-Swap/Redundant Components

System availability is maximized through the extensive use of hot-swap and redundant components, including:

- **Hot-swap, redundant hard disk drives** (with **RAID-1**/**10** protection standard and four other RAID levels optional)
- **Hot-swap, redundant power supplies** (optional)
- **Hot-swap, redundant cooling fans** (standard)

Light Path Diagnostics

Light path diagnostics enables a technician to quickly identify and locate a failed or failing system component, such as a specific fan or memory DIMM. This enables quick replacement of the component, which helps increase server uptime and lower operating costs.

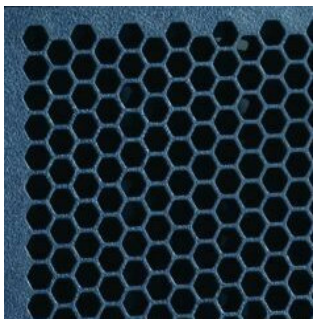
The front of the server has an LED indicator light to show possible component failures. If the front LED indicates an error condition, by pressing a button on the front of the server an LED panel will pop out and drop down for easy viewing without the need to open the server cover or remove the server from the rack. The light path diagnostics panel tells the servicer which component requires attention. In addition, many components have their own identifying LEDs. For example, each of the memory modules has an LED next to the socket, as does the processor, both adapter slots

[7] Variable read rate. Actual playback speed varies and is often less than the maximum possible.
[8] Data transfer rates depend on many factors and are often less than the maximum possible.
[9] RAID-5 and RAID-6 require three or four HDD, respectively; therefore they are available only on models with 2.5-inch HDDs.

all fans, both power supplies, the voltage regulator module and the service processor, allowing the servicer to easily identify exactly which component needs servicing. By following the "light path," the component can be replaced quickly, and without guesswork. (***Note:*** In the event of a failed DIMM, the system will restart and mark the DIMM as bad while offline, thus allowing the system to continue running, with reduced memory capacity, until serviced.)

Ultra-Efficient Cooling

Four strategically located fans, combined with efficient airflow paths, provide highly effective system cooling for the x3350, known as **Calibrated Vectored Cooling**. The base server with one power supply includes four hot-swap fans. In addition, each power supply also contains a fan.



The system contains **two cooling zones**. **Zone 1** (incorporating one or two fans) cools all 4 DIMM sockets, all hard disk drives, and adapter Slot 2. **Zone 2** (two or four fans) cools the processor, the optical drive, and Slot 1. Upgrading to optional hot-swap redundant cooling adds a second fan to Zone 1 and three more to Zone 2.

The fans automatically adjust speeds in response to changing thermal requirements, from a minimum of **7,000** RPMs to the maximum **15,000** RPMs, depending on the zone and internal temperatures. When the temperature inside the server increases, the fans speed up to maintain the proper ambient temperature. When the temperature returns to a normal operating level, the fans return to their default speed. Why not simply run the fans at 100% capacity all the time? For several good reasons: to reduce the ambient noise, reduce the wear-and-tear on the fans and reduce the server power draw. The reduction in ambient noise and power draw may be relatively minor for a single server, but put dozens or hundreds in a data center and it can make a big difference.

In addition, the server uses **hexagonal ventilation holes** in the chassis. Hexagonal holes can be grouped more densely than round holes, providing greater airflow through the system cover.

This cooling scheme is important because newer, more powerful processors generate a significant amount of heat, and heat must be controlled for the system to function properly.

Other Features

- **Four USB 2.0 ports** — Provides flexibility to add high-speed external devices. The USB 2.0 specification supports up to 480Mbps transfer rates. (***Note:*** Not all USB 2.0 devices are capable of achieving this rate.) Two ports are provided on the front of the server and two on the back.
- **Remote Supervisor Adapter II SlimLine** support — This optional "slotless" full-function advanced systems management adapter adds local and remote management functions.
- **Toolless slides** — Allows quick rack installation and quicker upgrade and servicing of the server.
- **Toolless chassis** — The cover can be opened without tools, and many components can be removed and replaced without tools, including the optical drive, the **Remote Supervisor Adapter II SlimLine**, the **PCI-E adapters**, the **fans**, **CD-ROM** drive, **adapter riser card**, the **hot-swap** or **simple-swap backplane**, and the **hot-swap** or **simple-swap HDDs**. This can save a servicer significant time.

Rack Cable Management and KVM Console Switching

IBM Advanced Cabling Technology (**ACT**) is an optional feature that offers many advantages over standard KVM cabling across the entire System x and xSeries product line. So now you can interconnect all of your servers with one smart cabling architecture. ACT cabling eliminates the need for one-to-one direct connections between each server and a KVM switch by using a daisy-chain approach.

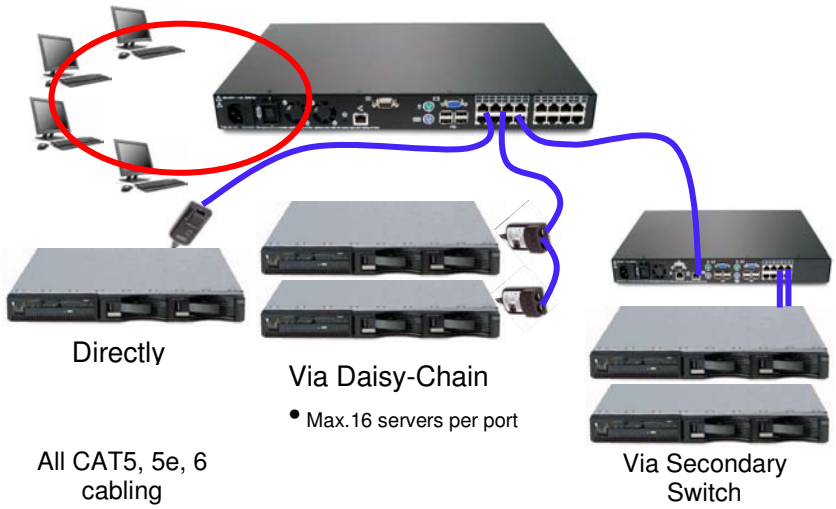
The snarl of cabling behind most racks is at best inconvenient to work around and at worst an expensive logistical nightmare, requiring the rewiring of servers, PDUs, KVM switches, and other equipment whenever a rack server is added or removed. Even worse, the veil of cables blocks rack airflow and can actually contribute to equipment failure due to overheating. ACT cabling is the solution for reducing behind-the-rack cabling by as much as **87%**.

Conventional cabling has bulky KVM cables exiting each server, which then connect to a KVM switch. The cables exiting a series of KVM switches must then be aggregated via additional KVM switches and PDUs, which only increases the number—and cost—of cables, KVM switches and PDUs. Instead, the daisy-chain approach of ACT cabling uses readily available, inexpensive CAT5 and 6 cabling to considerably *reduce* the number of cables, KVM switches, and PDUs needed, rather than increasing them. If a server is removed or added, no complicated rewiring is needed. One cable connects the first server in the rack to the next, and so on. Up to **16** servers form a chain; up to **8** chains can connect to one Local Console Manager (LCM); **16** LCMs can connect to one Global Console Manager (GCM). In this manner, up to **2,048 servers** can be centrally managed. Equally importantly, with ACT—unlike some other offerings—everything is

Please see the Legal Information section for important notices and information.

done externally via cabling; *no* special adapters are required.

The illustration below shows a sample ACT configuration:



Advanced Systems Management Capabilities

The x3350 has a high level of systems management capabilities that are well-suited to remote locations as well as to stand-alone environments. Features include the Baseboard Management Controller (BMC), Automatic Server Restart, Wake on LAN® support, PXE support, Predictive Failure Analysis, IBM Director, IBM Systems Director Active Energy Manager for x86, and support for an optional Remote Supervisor Adapter II SlimLine.

The **BMC** provides industry-standard **Intelligent Platform Management Interface** (**IPMI**) **2.0**-compliant systems management. It provides a number of important system functions, including:

- Monitoring of system and battery voltage, system temperature, fans, power supplies, processor and DIMM status
- Fan speed control
- Product ID and Family ID detection
- Highly secure remote power on/off
- System reset control
- NMI/SMI detection and generation
- System diagnostic LED control (power, HDD, activity, alerts, heartbeat)
- IPMI over LAN
- Serial Over LAN
- Proxy server support
- LAN messaging and alerting
- Text console redirection over LAN
- VLAN support
- Enhanced authentication and encryption algorithms (RMCP+, SHA-1, AES)
- Local update of BMC firmware
- Firmware firewall
- Support for IPMI v2.0 compliant management software (e.g., xCAT)
- Other mandatory and optional IPMI BMC functions

The BMC alerts IBM Director to anomalous environmental factors, such as voltage and thermal conditions—even if the server has failed.

The x3350 also supports an optional IBM **Remote Supervisor Adapter II SlimLine** for additional systems management capabilities, including:

- Graphical console redirection over LAN
- Web-based out-of-band control

- Windows "blue screen" capture
- Remote virtual floppy and CD-ROM
- High-speed remote redirection of PCI video, keyboard and mouse
- SSL (Secure Socket Layer) and LDAP (Lightweight Directory Access Protocol) support

Automatic Server Restart (ASR) helps reduce downtime by restarting the server automatically in the event of a system lockup. ASR technology is a combination of hardware circuitry tied into the server's system reset function and a device driver. As long as the server continues running, the ASR watchdog timer will keep being reset, but if the operating system crashes or the hardware freezes somehow the ASR software will be unable to reset the hardware timer. If the timer is not reset within five minutes, it automatically triggers the ASR hardware, which immediately restarts the server (and logs an ASR event with IBM Director). These features are designed so that *no more than five minutes can pass before the server is restarted*.

Wake on LAN permits the server to be remotely powered on if it has been shut off. Once powered up, the server can be controlled across the network, using the **Preboot Execution Environment** (PXE).

Like Wake on LAN, PXE is system firmware. It enables software such as the optional **IBM Remote Deployment Manager** to take control of a system before the BIOS, operating system or applications are loaded (using Wake on LAN/PXE) and lets an administrator perform many low-level tasks remotely that would otherwise require a visit to each system. These tasks may include such things as formatting a hard disk drive, updating system firmware, or deploying a Windows or Linux operating system.

Predictive Failure Analysis (PFA) is designed to allow the x3350 to detect impending failure of supported components (processors, memory, fans and hard disk drives) as much as 48 hours before actual failure, and alert the administrator through IBM Director. This gives customers the ability to replace the failing component *before* it fails, resulting in increased uptime.

IBM Director software for advanced workgroup management is included with the x3350. IBM Director comes with a portfolio of tools, including *Management Processor Assistant, Rack Manager, RAID Manager, Update Assistant and Software Distribution. IBM Systems Director Active Energy Manager for x86, System Availability* (a no-charge download) and *Capacity Manager* (sold separately) are available as add-ons for additional server management and increased availability. IBM Director provides a single uniform graphical interface for all of these systems management functions.

IBM Director enables the customer to customize thresholds and monitor system components (for things like temperature, voltage regulation, etc.) to help maximize uptime.

IBM developed IBM **Systems Director Active Energy Manager for x86** to put control of system power-saving features at the fingertips of administrators. Active Energy Manager is a combination of hardware and software designed to take advantage of new features, such as monitoring power usage and balancing the performance of the system according to available power input. It provides the ability to plan and predict power consumption based on your hardware configuration. It also helps enable you to reduce the infrastructure required for redundancy, by using fewer servers on smaller power feeds and potentially lowering your overall data center support costs. It does this by inventorying all components, then adding up the total power draw and tracking the usage.

Extensive System Support Features

The IBM services and technical support portfolio provides world-class, consistent, high-quality service and support. The x3350 server offers a number of tools and services designed to make ownership a positive experience. From the start, IBM programs make it easier for customers to plan for, configure and purchase System x or xSeries servers, get them running and keep them running long-term. These features include IBM Express Portfolio, IBM ServerProven®, the IBM Standalone Solutions Configuration Tool, IBM System x and BladeCenter Power Configurator, IBM ServerGuide, IBM Electronic Service Agent™, Product Customization Services and extensive technical support offerings.

The IBM **ServerProven** program provides the confidence that specific options and operating systems have been tested on the server and are officially supported to work together. It is updated frequently to ensure that the latest compatibility information is always at your customers' fingertips.

The IBM **Standalone Solutions Configuration Tool** (SSCT) is a downloadable tool that simplifies the often complex chore of configuring a full rack of servers (including blade servers) and confirming that you have all the cables, power distribution units, KVM (keyboard, video and mouse) switch boxes and other components you need, as well as the proper airflow clearances, electrical circuits and other environmental conditions.

IBM **System x and BladeCenter Power Configurator** helps IT managers plan for data center

Please see the Legal Information section for important notices and information.

power needs, by providing the following information for specific configurations of System x and BladeCenter systems: *power input* (watts), *PDU sizing* (amps), *heat output* (BTUs), *airflow requirements through chassis* (CFM), *VA rating*, *leakage current* (mA), and *peak inrush current* (amps).

IBM **ServerGuide** (installed from CD) simplifies the process of installing and configuring System x and xSeries servers. ServerGuide goes beyond mere hardware configuration by assisting with the automated installation of the Microsoft® Windows® Server 2000 and 2003 operating systems, device drivers and other system components, with minimal user intervention. (Drivers are also included for support of Novell NetWare, Red Hat Linux and SUSE LINUX.) This focus on deployment helps customers reduce both their total cost of ownership and the complexity that administrators and technical personnel face.

IBM **Electronic Service Agent**™ is an innovative "call home" feature that allows System x and BladeCenter servers to automatically report hardware problems to IBM support, which can even dispatch onsite service[10] if necessary to those customers entitled to onsite support under the terms of their warranty or an IBM Maintenance Agreement. Electronic Service Agent resides on a server and provides electronic support and problem management capabilities through a highly secure electronic dialogue between your systems and IBM. It monitors networked servers for hardware errors and it can perform hardware and software inventories and report inventory changes to IBM. All information sent to IBM is stored in a highly secure database and used for improved problem determination.

Additional services include hardware warranty upgrades and factory-installed **Product Customization Services** (PCS), such as asset tagging, hardware integration, software imaging and operating systems personalization.

IBM offers extensive **technical support** by phone and via the Web. Support options include links to forums/newsgroups, problem submission, online shopping support, service offerings, device drivers for all IBM product lines, software downloads and even upcoming technical seminar worldwide schedules and registration. Also available are remote installation, configuration and usage support for System x and xSeries hardware and software, as well as onsite custom services to give customers the level of expertise they require.

Key Options

IBM options for System x servers help customers take their servers to a higher level

Make sure that customers know they can rely on System x options to supply a complete solution for their business needs. Options help them create an optimized server system to meet their data protection, storage and availability needs. Every IBM option is designed and tested for peak performance and flexibility, helping to maximize the customer's return on investment. The combination of System x servers and options lets customers keep their fingers on the pulse of their e-business.

Memory — Memory is a significant factor in systems application performance. Adding more memory to a System x server is one of the most effective ways to increase application performance. For best performance in a server with a dual-core processor, there should be twice as much memory available as for a single-core processor. The x3350 supports 1, 2, or 4 DIMMs and provides two-way interleaving for improved performance when more than one DIMM is installed.

Hard Disk Drives — IBM hard disk drives help customers improve the transaction and cost performance of their System x servers. The choice of hard disk drives can be a critical aspect of maximizing the I/O throughput of the system. **SAS** hard disk drives are available for the x3350 with capacities up to **300GB** (3.5-inch) apiece at **10,000** RPMs and up to **146.8GB** at **15,000** RPMs; or up to **146.8GB** (2.5-inch) at **10,000** RPMs. **SATA** 3.5-inch hard disk drives are available with capacities up to **750GB** apiece at **7,200** RPMs.

Remote Supervisor Adapter II SlimLine — The x3350 includes a plethora of systems management features built-in; however, sometimes additional management capability is needed. In those situations, the Remote Supervisor Adapter II SlimLine offers powerful new features.

RAID Controllers — System x servers using embedded RAID technology allow companies to build a reliable foundation for business-critical computing. RAID technology allows an array consisting of multiple physical hard disk drives to be treated as one logical drive. RAID technology also allows data to be stored redundantly, across multiple hard disk drives—enhancing both the integrity and the availability of the data. SAS/SATA RAID controllers offer enhanced performance due to onboard processors and cache. Because RAID controllers can help significantly improve data transfer rates, this technology is extremely effective when implementing demanding, transaction-oriented applications. By employing the advanced fault tolerance of RAID technology, companies can effectively implement networked business systems that require large amounts of storage space for data and applications that must be available for

[10] For onsite labor, IBM will attempt to diagnose and resolve the problem remotely before sending a technician.

Please see the Legal Information section for important notices and information.

their businesses to continue operating.

The optional IBM **SAS HBA** controller offers **RAID-0/1/1E** support for external SAS/SATA HDDs.

The optional **ServeRAID-MR10i** is a full-height/half-length PCI-E x8 card that offers high performance (and optionally **256MB** of write-back ECC cache memory with battery backup) for *internal* **SAS/SATA** storage, as well as external SAS/SATA storage. The adapter supports **five** RAID levels on the x3350: **0** (striping), **1** (mirroring), **10** (mirroring and striping), **5** (striping with parity), and **6** (striping with dual parity). (While the controller also supports RAID 50 and 60, there are insufficient drive bays in the x3350 to utilize those RAID levels.)

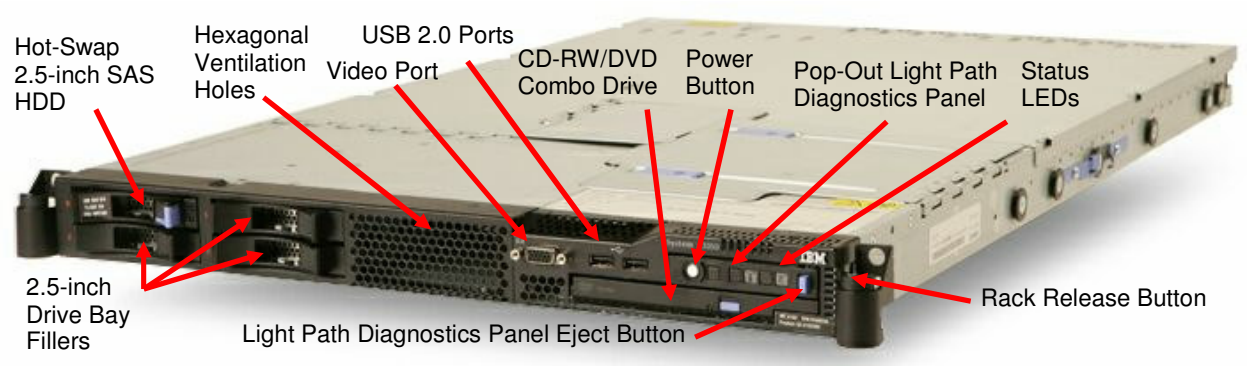
The optional **ServeRAID-MR10M** PCI-E x8 controller offers high performance and **256MB** of cache memory with battery backup for *internal* and *external* SAS storage capacity. The adapter supports **seven** RAID levels: **0**, **1**, **10**, **5**, **50** (striping/mirroring with parity), **6** (double parity) and **60** (double parity with mirroring).

External Storage — The IBM **TotalStorage DS3000, DS4000, DS6000,** and **DS8000** series, as well as the **System Storage DS4000, N3000, N5000, and N7000** series, comprise a powerful and broad shared storage family with integrated management software designed to meet midrange and enterprise needs. For lower-end needs, IBM offers the TotalStorage **DS400** storage enclosure.

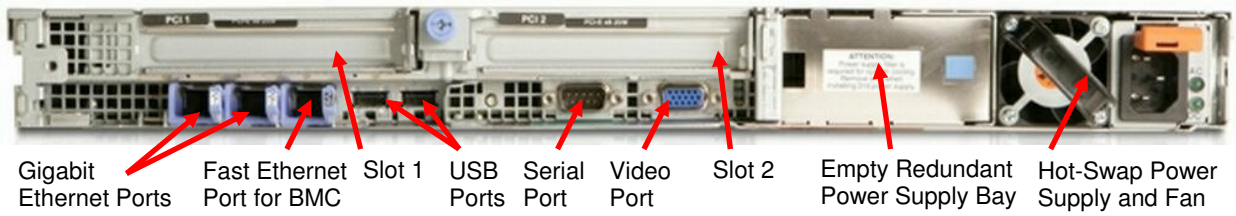
External SAN, iSCSI, and direct-attach storage is available using one of several IBM System Storage and TotalStorage host bus adapters. Additionally, external LAN-attached tape storage is available.

x3350 Images

Front View

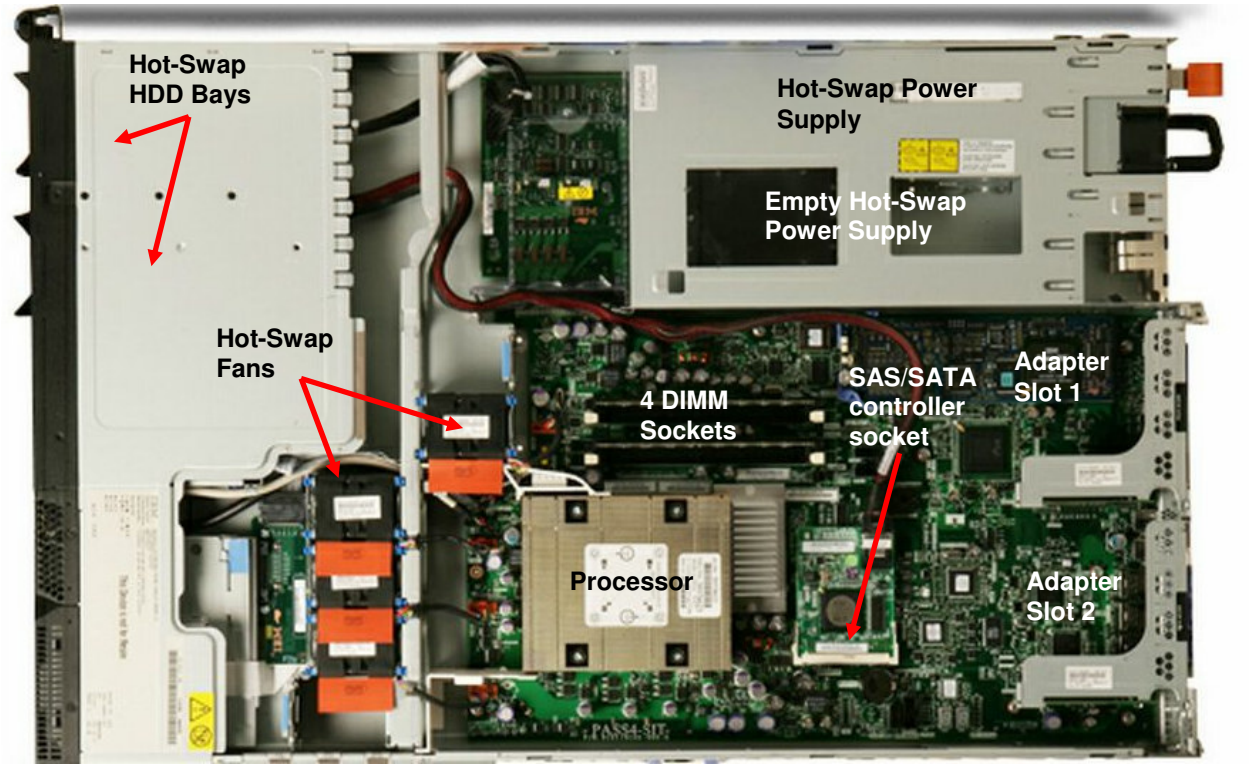


Rear View



Please see the Legal Information section for important notices and information.

Interior View



x3350 Specifications				
Machine type	**4192-3xX/3xY, 4xX/4xY, 5xX/5xY, 6xX/6xY, 7xX/7xY, 8xX/8xY (1 yr warranty)** **4193-3xX/3xY, 4xX/4xY, 5xX/5xY, 6xX/6xY, 7xX/7xY, 8xX/8xY (3 yr warranty)**			
Form factor	1U			
Processor type	**Quad-core Xeon (X33xx)** **2.5GHz** X3320 (6xX/6xY), **2.66GHz** X3350 (7xX/7xY), **2.83GHz** X3360 (8xX/8xY)	**Dual-core Xeon (E31xx)** **3.0GHz** E3110 (5xX/5xY)	**Dual-core Xeon (30xx)** **2.33GHz** 3065 (3xX/3xY), **2.66GHz** 3075 (4xX/4xY)	
Maximum processor power draw	**95W** (6xX/6xY, 7xX/7xY, 8xX/8xY)—**23.75W** per core		**65W** (3xX/3xY, 4xX/4xY, 5xX/5xY)—**32.5W** per core	
Front-side bus (FSB) speed	**1333MHz**			
# of processors standard / maximum	1 / 1			
Internal L2 cache	**12MB** (independent 2 x 6MB)—7xX/7xY, 8xX/8xY	**6MB** (independent 2 x 3MB)—6xX/6xY	**6MB** (1 x 6MB)—5xX/5xY	**4MB** (1 x 4MB)—3xX/3xY, 4xX/4xY
Chipset	Intel 3210			
Standard / maximum memory[11]	**2GB** (2 x 1GB) / **8GB**—6xX/6xY, 7xX/7xY, 8xX/8xY		**1GB** (2 x 512MB) / **8GB**—3xX/3xY, 4xX/4xY, 5xX/5xY	

[11] Maximum memory and disk capacity may require the replacement of standard components with the largest supported component available.

Please see the Legal Information section for important notices and information.

A highly-affordable, ultradense, uniprocessor server delivering power-optimized performance for non-virtualized application workloads

x3350 Specifications				
Standard memory type	PC2-5300 (**667MHz**) DDR II ECC			
Memory interleaving	Two-way (using multiples of 2 DIMMs; noninterleaved with one DIMM)			
DIMM capacities supported	512MB, 1GB, 2GB			
# of DIMM sockets total / available	4 / 2			
Online spare memory supported / # of DIMM sockets reserved for sparing	N/A			
Memory mirroring supported / # of DIMM sockets reserved for mirroring	N/A			
# of drive bays total / available	**3** / **2** (3xX/3xY, 4xX/4xY, 5xX/5xY)		**5** / **4** (6xX/6xY**,** 7xX/7xY, 8xX/8xY)	
# of HDD drive bays total / available	2 / 2 **3.5-inch** (3xX/3xY, 4xX/4xY, 5xX/5xY)		4 / 4 **2.5-inch** (6xX/6xY**,** 7xX/7xY, 8xX/8xY)	
# of 5.25" bays total / available	1 / 0 (optical drive installed)			
Disk drive technology	**Hot**-swap **3.5-inch** SAS/SATA[12] (44X/44Y, 5xX/5xY)	**Hot**-swap **2.5-inch** SAS (6xX/6xY**,** 7xX/7xY, 8xX/8xY)	**Simple**-swap SATA (3xX/3xY, 42X/42Y)	
Maximum HDD capacity	**600GB** (2 x 300GB) **hot**-swap **3.5**-inch **SAS** (44X/44Y, 5xX/5xY)	**587.2GB** (4 x 146.8GB) **hot**-swap **2.5**-inch **SAS** (6xX/6xY**,** 7xX/7xY, 8xX/8xY)	**1.5TB** (2 x 750GB) **hot**-swap **3.5**-inch **SATA** (44X/44Y, 5xX/5xY)	**1.5TB** (2 x 750GB) **simple**-swap **3.5**-inch **SATA** (3xX/3xY, 42X/42Y)
HDD capacities supported	**3.5**-inch **SAS** 73.4, 146.8, **300GB** — **10K** RPMs; 73.4, **146.8GB** — **15K** RPMs	**2.5**-inch **SAS** 73.4, **146.8GB** — **10,000** RPMs	**3.5**-inch **SATA** 160, 250, 500, **750GB** — **7,200** RPMs	
# of HDDs standard	None			
# of optical drives standard	1 **CD-RW/DVD-ROM Combo** (24X/24X/24X/10X, in dedicated 5.25" bay)			
# of diskette drives standard	None (optional)			
Internal tape drives supported	None (externally attached)			
Integrated disk controller	Four-port **LSI 1064E** (hot-swap SAS/SATA models) **3Gbps**; Processor chipset (simple-swap SATA models)			
# of disk drives supported *per port*	1			
External disk drives supported	Yes, via IBM SAS HBA			
Integrated RAID controller	**LSI 1064E** (**hot**-swap SAS/SATA models)—RAID-0/1			
Optional RAID controllers supported	**LSI 1064E** (**simple**-swap SAS/SATA models)—internal SAS/SATA **IBM SAS HBA**—external SAS/SATA/tape **IBM ServeRAID-MR10i**—internal SAS/SATA **IBM ServeRAID-MR10M**—internal/external SAS/SATA			
# of adapter slots total / available	2 / 2			
# of PCI-E x8 slots (4GBps)	2 (full-height, half-length)			
# of PCI-E x4 slots (2GBps)	None			
# of PCI-X/133 slots (1GBps)	None			
# of 33MHz legacy PCI slots	None			

[12] Hot-swap SATA drives are supported in special bid or CTO systems only.

x3350 Specifications		
# of video ports	1 (front)	
Video controller	ATI Radeon ES1000	
Video memory	64MB SDRAM (only 16MB is used/needed)	
Maximum video resolution at 32-bit color	1024 x 768 x 32-bit color at 75Hz	
Gigabit Ethernet controllers	2 x Broadcom **BCM5722**	
# of Gigabit Ethernet ports	2 (rear)	
# of RS485 ports	None	
# of serial ports	1 (rear)	
# of parallel ports	1 (rear)	
# of mouse ports	None (USB-attach)	
# of keyboard ports	None (USB-attach)	
# of USB 2.0 ports	**4** (2 front, 2 rear) ports	
Integrated systems management controller	Yes (BMC)	
Optional advanced systems management adapter	Remote Supervisor Adapter II SlimLine	
Light path diagnostics support	Yes, with external pop-out/drop-down panel	
Predictive Failure Analysis support	Memory, power supplies, hard disk drives, and fans	
Power supply size	450W universal, autoswitching	
# of power supplies standard / maximum	1 / 2	
Hot-swap/redundant power supported	N/A	
# of fans/blowers standard / maximum	4 / 8	
Hot-swap/redundant fans supported	N/A	
Heat emitted: minimum / maximum	396 – 1365 BTUs / 116 – 400 watts	
Rack mount method	Toolless slides (provided standard)	
Maximum altitude	7,000 ft; 2,133 m	
Operating temperature range	50 – 95º F; 10 – 35º C (up to 3,000 ft / 914.4 m)	50 – 90º F; 10 – 32º C (3,000 ft to 7,000 ft / 914.4m to 2,133m)
Dimensions (HWD) / weight	1.7" (43mm) **H** 17.3" (440mm) **W** 28.0" (711.4mm) **D**	28.0 (minimum) – 34.5 **lb** (maximum) 12.7 – 15.6 **kg**
Operating systems supported	Microsoft Windows Server 2003 and 2003 R2 (Standard/Web/Enterprise Editions) 32/64-bit, Microsoft Windows SBS 2003 and 2003 R2 SE/PE, RHEL 4/5 32/64-bit, SLES 9/10 32/64-bit, SUSE Open Enterprise Server 9, Novell NetWare 6.5, Novell NetWare Open Enterprise Server	
Length of limited warranty	3 years (parts and labor)[13]—Machine Type 4193	1 year (parts and labor)—Machine Type 4192

[13] For terms and conditions or copies of the IBM Statement of Limited Warranty, call 800-772-2227 in the U.S. In Canada call 800-426-2255. IBM makes no representation or warranty regarding third-party products or services including those designated as

The Bottom Line

The x3350 is an extremely powerful system, incorporating leading-edge industry-standard features and adding IBM-unique innovations:

Performance

- **High-throughput processors** — **2.33** to **3.0GHz dual-core** or **2.5** to **2.83GHz quad-core Xeon** processors
- **Large, high-speed cache** — **12MB** or **6MB** (quad-core Xeon) or **6MB** or **4MB** (dual-core Xeon) of L2 processor cache
- **64-bit extensions** (EM64T)
- **Leading-edge front-side bus** — **1333MHz** FSB
- **Fast memory** — **667MHz PC2-5300 DDR II** ECC memory standard with **two-way interleaving** (using two or more DIMMs)
- **Fast disk technology** — Integrated 3Gbps **SAS**/**SATA** controller and slotless hardware-based **RAID-0** data striping (hot-swap SAS/SATA models) or **SATA II** controller (simple-swap SATA models)
- **Fast communications** — Two integrated **Gigabit Ethernet** controllers
- **Fast I/O** — **PCI-E x8** adapter slots

Flexibility

- The choice of dual-core or quad-core **Xeon** processor
- **Large memory capacity** — Up to **8GB** of **ECC memory**, using **4** DIMMs
- The choice of **two 3.5-inch hot-swap** SAS or SATA II drives, or **four 2.5-inch hot-swap** SAS drives, or **two 3.5-inch simple-swap** SATA II drives
- **Choice of disk storage** — Up to **1.5TB** of internal SATA II storage, **600GB** of internal SAS storage (**3.5**-inch), or **587.2GB** of internal SAS storage (**2.5**-inch)
- **High-performance external expansion** — **Four** 480Mbps **USB 2.0** ports (two front, two rear)
- Hardware-based **RAID-0**/**1** support (standard in **hot**-swap models, optional in **simple**-swap models); upgradeable to internal **RAID-0**/**1**/**10**/**5**/**6** using the optional **ServeRAID-MR10i** controller or internal/external **RAID-0**/**1**/**10**/**5**/**50**/**6**/**60** using the optional **ServeRAID-MR10M** controller. (RAID-50/60 applies to external arrays only. The x3350 has insufficient drive bays to support RAID-50/60.)
- **Two** *available* **PCI-E** adapter slots
- Integrated **CD-RW**/**DVD-ROM** optical drive

Manageability, Serviceability and Availability

- **IBM Director** systems management software, including:
  - ❑ IBM Management Processor Assistant
  - ❑ IBM Rack Manager
  - ❑ IBM RAID Manager
  - ❑ IBM Update Assistant
  - ❑ IBM Software Distribution
  - ❑ IBM System Availability
- **IBM Systems Director Active Energy Manager for x86**
- **Integrated Baseboard Management Controller** (BMC) with **IPMI 2.0** compliance, including highly secure remote power control
- **ECC memory correction**
- **PFA support** for memory, power supplies, hard disk drives, and fans
- Slotless hardware-based **RAID-1** disk mirroring standard; optional **RAID-10**/**5**/**6** highly available arrays
- **Hot-swap SAS or SATA** hard disk drives or **simple-swap SATA** drives
- **Ultra-efficient cooling** incorporating **Calibrated Vectored Cooling** features
- **Light path diagnostics** (front LED panel, drop-down light path panel)
- Optional **Remote Supervisor Adapter II SlimLine** daughter card (no slot required)
  - ❑ Supports **LDAP** and **SSL** industry standards

ServerProven or ClusterProven. Telephone support may be subject to additional charges. For warranties including onsite labor, a technician is sent after IBM attempts to resolve the problem remotely. International warranty service is available in any country in which this product is sold.

- **Toolless chassis** and **toolless slide** design

Please see the Legal Information section for important notices and information.

For More Information

IBM System x and xSeries Servers	**ibm.com**/systems/x
Electronic Service Agent	**ibm.com**/support/electronic
IBM System x and BladeCenter Power Configurator	**ibm.com**/systems/bladecenter/powerconfig
Standalone Solutions Configuration Tool	**ibm.com**/servers/eserver/xseries/library/configtools.html
ServerProven Program	**ibm.com**/servers/eserver/serverproven/compat/us
Technical Support	**ibm.com**/server/support
Other Technical Support Resources	**ibm.com**/servers/eserver/techsupport.html
Configuration and Options Guide	**ibm.com**/servers/eserver/xseries/cog

Legal Information

© IBM Corporation 2008

IBM Systems and Technology Group
Dept. U2SA
3039 Cornwallis Road
Research Triangle Park, NC 27709

Produced in the USA
January 2008
All rights reserved

For a copy of applicable product warranties, write to: Warranty Information, P.O. Box 12195, RTP, NC 27709, Attn: Dept. JDJA/B203. IBM makes no representation or warranty regarding third-party products or services including those designated as ServerProven or ClusterProven. Telephone support may be subject to additional charges. For onsite labor, IBM will attempt to diagnose and resolve the problem remotely before sending a technician.

IBM, the IBM logo, the e-business logo, iSeries, Predictive Failure Analysis, ServeRAID, System i, System Storage, System x, TotalStorage, xSeries and X-Architecture are trademarks of IBM Corporation in the United States and/or other countries. For a list of additional IBM trademarks, please see http://**ibm.com**/legal/copytrade.shtml.

Linux is a registered trademark of Linus Torvalds.

Microsoft, Windows and the Windows logo are trademarks or registered trademarks of Microsoft Corporation.

Other company, product and service names may be trademarks or service marks of others.

IBM reserves the right to change specifications or other product information without notice. References in this publication to IBM products or services do not imply that IBM intends to make them available in all countries in which IBM operates. IBM PROVIDES THIS PUBLICATION “AS IS” WITHOUT WARRANTY OF ANY KIND, EITHER EXPRESS OR IMPLIED, INCLUDING THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. Some jurisdictions do not allow disclaimer of express or implied warranties in certain transactions; therefore, this statement may not apply to you.

This publication may contain links to third party sites that are not under the control of or maintained by IBM. Access to any such third party site is at the user's own risk and IBM is not responsible for the accuracy or reliability of any information, data, opinions, advice or statements made on these sites. IBM provides these links merely as a convenience and the inclusion of such links does not imply an endorsement.

Information in this presentation concerning non-IBM products was obtained from the suppliers of these products, published announcement material or other publicly available sources. IBM has not tested these products and cannot confirm the accuracy of performance, compatibility or any other claims related to non-IBM products. Questions on the capabilities of non-IBM products should be addressed to the suppliers of those products.

MB, GB and TB = 1,000,000, 1,000,000,000 and 1,000,000,000,000 bytes, respectively, when referring to storage capacity. Accessible capacity is less; up to 3GB is used in service partition. Actual storage capacity will vary based upon many factors and may be less than stated.

Performance is in Internal Throughput Rate (ITR) ratio based on measurements and projections using standard IBM benchmarks in a controlled environment. The actual throughput that any user will experience will depend on considerations such as the amount of multiprogramming in the user’s job stream, the I/O configuration, the storage configuration and the workload processed. Therefore, no assurance can be given that an individual user will achieve throughput improvements equivalent to the performance ratios stated here.

Maximum internal hard disk and memory capacities may require the replacement of any standard hard drives and/or memory and the population of all hard disk bays and memory slots with the largest currently supported drives available. When referring to variable speed CD-ROMs, CD-Rs, CD-RWs and DVDs, actual playback speed will vary and is often less than the maximum possible.

XSO03040-USEN-00